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A NEW SEQUOIOXYLON FROM FLORISSANT, COLORADO[1]

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The Miocene lake bed at Florissant, Colorado, has long been recognized for its wealth of fossil plants, insects, and vertebrates. The excellence of the leaf impressions found in these sedimentary deposits is second to few localities in the world and certainly the silicified trunks and stumps, at least as regards size, are unsurpassed. The Florissant flora has been generally accepted by competent paleobotanists as being of Miocene age (Berry, '29, p. 234). More recently, Gazin ('35), in describing a marsupial (*Peratherium* sp.) from this formation, suggests a lower Tertiary age. The weight of evidence at present, however, is in support of the Miocene.

Of the score or more of stumps that have been excavated at the Henderson Petrified Forest (located 2½ miles south of Florissant) one in particular is outstanding because of its magnitude. The stump was mentioned by Gordon ('34) in a recent address before the British Association as follows: "The largest fossil tree I know, and I think it is the largest yet discovered, is a stump said to be of the *Sequoia* type. . . . It is 17½ feet in diameter and 10 feet high, quite comparable in girth, therefore, with the Big Trees of today." Henderson ('06) writes of the abundance of fossil stumps at Florissant and figures one, said

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to be a *Sequoia,* which unquestionably is the same one mentioned by Gordon and described in this paper (pl. 20, fig. 1). According to Henderson, unsuccessful attempts were made to cut sections of the trunk for exhibition purposes.

Apparently no anatomical studies of this stump have ever been published despite its unusual interest. The wood is infiltrated with silica and only slightly replaced, the preservation being very good with the exception of the pitting in the radial walls of the ray cells. A few ground sections were prepared, but due to the fragility of the wood satisfactory transverse sections could not be obtained by the usual method. Consequently, small fragments were desilicified in a solution of ⅓ hydrofluoric acid and ⅔ alcohol for 3–4 days, then embedded in celloidin, and cut on a sliding microtome. Very satisfactory transverse sections were obtained using this method, but desilicification rendered the radial sections of less value than the ground ones.

SEQUOIOXYLON PEARSALLII, N. SP.

Annual rings.—Well-defined, comprised mostly of large, thin-walled cells, the greater portion of which have been crushed (pl. 20, fig. 3); relatively little summer wood, transition varying from abrupt (pl. 21, fig. 7) to gradual (fig. 6).

Resin canals.—Neither normal nor traumatic resin canals observed.

Wood parenchyma.—Abundant, more so in late spring and summer wood, diffuse, resinous; cells markedly smaller in diameter than surrounding tracheids.

Wood rays.—Few to 30 or more cells high, mostly uniseriate, occasionally biseriate; apparently one to two pits per cross field although the preservation of this feature is very poor, horizontal walls sparingly pitted but no pitting observed in cross (tangential) walls; marginal ray cells larger and more nearly resembling true ray tracheids than the ray parenchyma, also entirely lacking the resinous (?) contents of the latter (text-fig. 1).

Tracheids.—Pitting uniseriate (mostly scattered) and biseriate (usually opposite); crassulae not observed; tangential

pitting abundant in late summer wood (pl. 20, fig. 5). Strand tracheids occasionally found in summer wood composed of short tracheary elements interspersed with parenchyma cells, both horizontal and *vertical* septations occur, the vertical septations always extending in a radial direction (pl. 20, fig. 4, pl. 21, fig. 9).

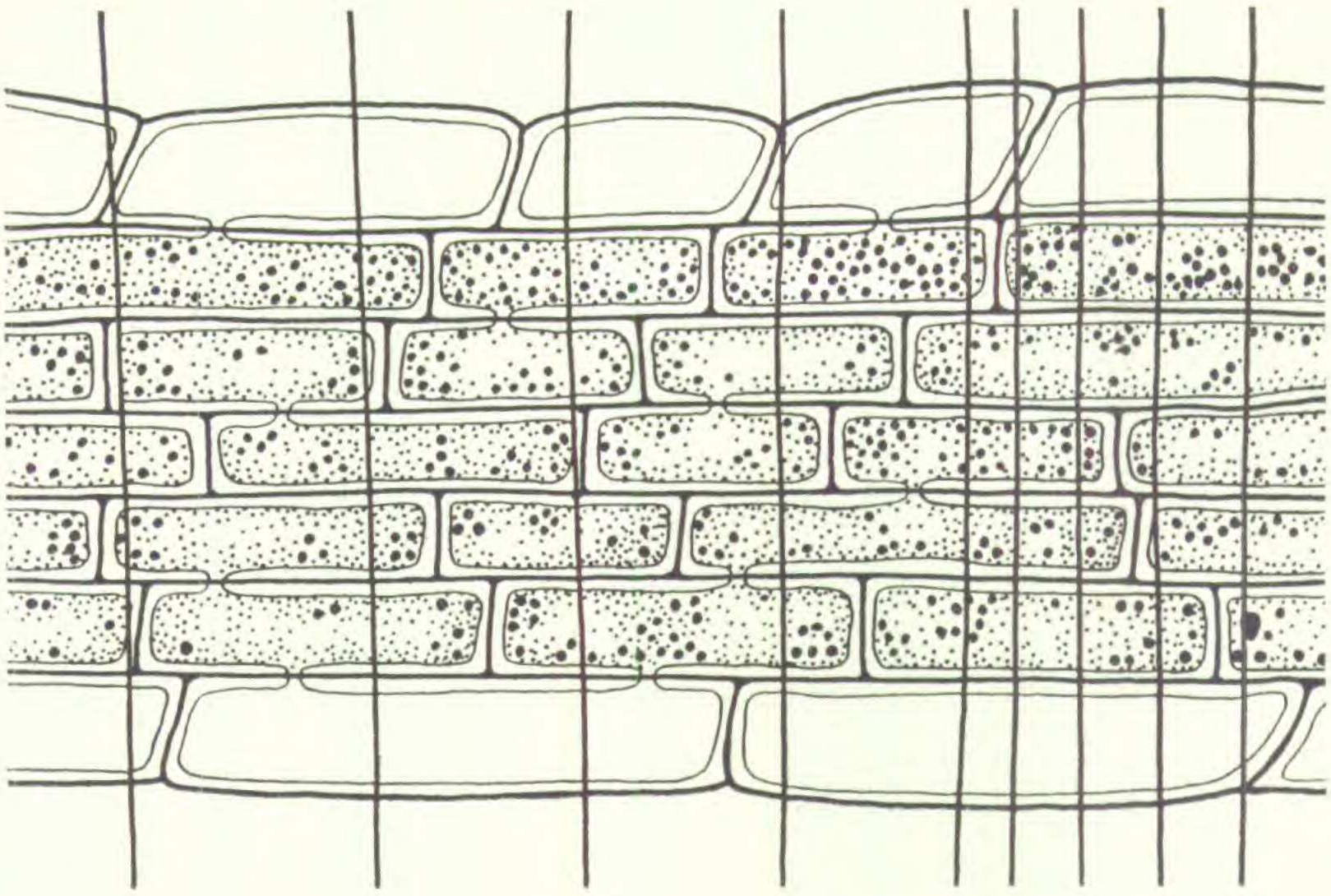

Fig. 1. *Sequoioxylon Pearsallii.* Radial longitudinal view of ray, showing pitting of horizontal walls and differentiated marginal cells.

The species is named for Mr. Cortland Pearsall, of the Massachusetts Institute of Technology, for his valuable assistance in the field and laboratory.

With the exception of the ray structure the general anatomy of the wood indicates a close relationship to *Sequoia,* and although traumatic resin canals have not been observed we feel justified in placing the wood in the genus *Sequoioxylon.* The two most interesting and distinctive features of this wood are the ray structure and the presence of strand tracheids.

The strand tracheids, with their horizontal and *radio-longitudinal* septations composed of short tracheary elements interspersed with parenchyma cells, are, to the writer's knowledge,

a previously undescribed feature in fossil woods. Dr. I. W. Bailey ('34) has described uniseriate strand tracheids in the living redwood *(Sequoia sempervirens)* and has kindly advised the writer that the biseriate type (pl. 20, fig. 4; pl. 21, fig. 9) is of common occurrence in injured crowns of that tree, but apparently figures of the feature have never been published. A band of the strand tracheids is shown in tangential view in the late summer wood in pl. 21, fig. 8 and portions of the same are shown more highly magnified in pl. 20, fig. 4 and pl. 21, fig. 9. The longitudinal septations extend only radially as may be seen by their complete absence in radial section (pl. 20, fig. 2). As this feature is not of constant occurrence at the end of every ring it is doubtful whether it is of any phylogenetic significance; it is more likely that the longitudinal septations are the result of traumatism.

The differentiation of the marginal ray cells is a constant feature and not merely of sporadic occurrence as in the living *Sequoia.* Although not true ray tracheids they are usually distinctly larger than the remainder of the ray cells, more nearly resemble true ray tracheids in shape, and are entirely lacking the ergastic or resinous (?) contents characteristic of most of the ray cells (text-fig. 1).

The wood under consideration seems to resemble *Sequoia Penhallowii* Jeffrey more closely than any other described species of Sequoian affinities. Our specimen differs, however, from *S. Penhallowii* not only in its lack of horizontal and vertical resin canals, but also in a greater abundance of wood parenchyma and lack of pitting in the tangential walls of the ray cells. Undoubtedly we are dealing with a transitional form between the old Abietinean stock and the present-day Sequoias, although, to be sure, the wood described here is much closer to the living *Sequoia* than their Abietinean ancestors.

Like most of our fossil forests the one at Florissant seems to have been rather badly neglected as regards detailed anatomical studies of the silicified stumps and trunks. It would seem that a study of the annual rings of some of the larger specimens might throw some light on the climatic conditions existing there during the Miocene.

Literature

Bailey, I. W. ('34). The cambium and its derivative tissues. IX. Structural variability in the redwood. Jour. Arn. Arb. **15**: 233–254.

Berry, E. W. ('29). A revision of the flora of the Latah formation. U. S. Geol. Survey, Prof. Paper 154: 225–266.

Cockerell, T. D. A. ('06). The fossil fauna and flora of the Florissant (Colorado) shales. Univ. Colo. Stud. **3**: 157–176.

————, ('08). The fossil flora of Florissant, Colorado. Am. Mus. Nat. Hist. Bull. **24**: 71–110.

————, ('10). The Miocene trees of the Rocky Mountains. Am. Nat. **44**: 31–47.

Gazin, C. L. ('35). A marsupial from the Florissant beds (Tertiary) of Colorado. Jour. Paleontol. **9**: 57–62.

Gordon, W. T. ('34). Plant life and the philosophy of geology. Brit. Assn. Adv. Sci. Rept. **104**: 49–82.

Henderson, J. ('06). The Tertiary lake bed of Florissant, Colorado. Univ. Colo. Stud. **3**: 145–156.

Jeffrey, E. C. ('04). A fossil Sequoia from the Sierra Nevada. Bot. Gaz. **38**: 321–332.

Kirchner, W. C. G. ('98). Contribution to the fossil flora of Florissant, Colorado. St. Louis Acad. Sci. Trans. **8**: 161–188.

Torrey, R. E. ('21). Telephragmoxylon and the origin of wood parenchyma. Ann. Bot. **25**: 73–77.

————, ('23). Comparative anatomy and phylogeny of the Coniferales. Part 3. Mesozoic and Tertiary coniferous woods. Bost. Soc. Nat. Hist. Mem. **6**: 41–106.

Warder, R. B. ('83). The silicified stumps of Colorado. Am. Assn. Adv. Sci. Proc. **31**: 398–399.

EXPLANATION OF PLATE

PLATE 20

Sequoioxylon Pearsallii, n. sp.

Fig. 1. Photograph of the stump, Henderson Petrified Forest, Florissant, Colo.
Fig. 2. Radial view of the strand tracheids.
Fig. 3. Transverse section through two annual rings.
Fig. 4. Tangential view of strand tracheids.
Fig. 5. Tangential view showing tangential pitting in late summer tracheids.

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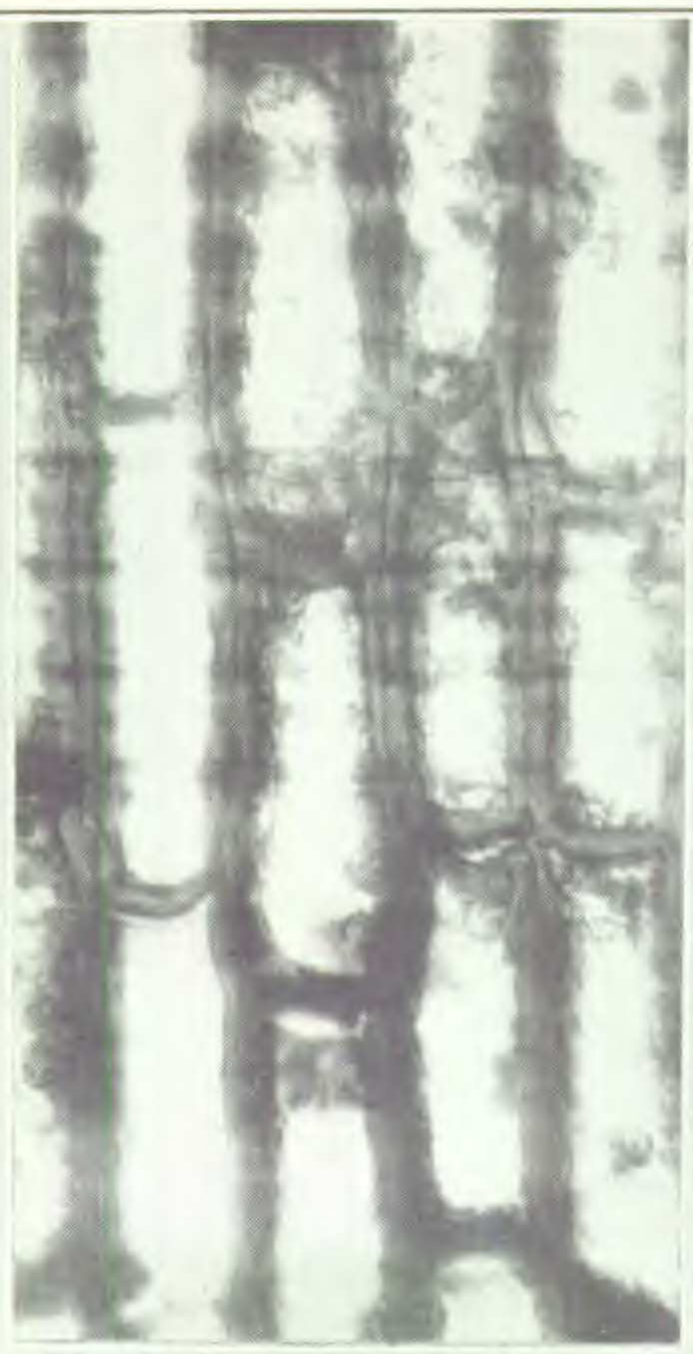

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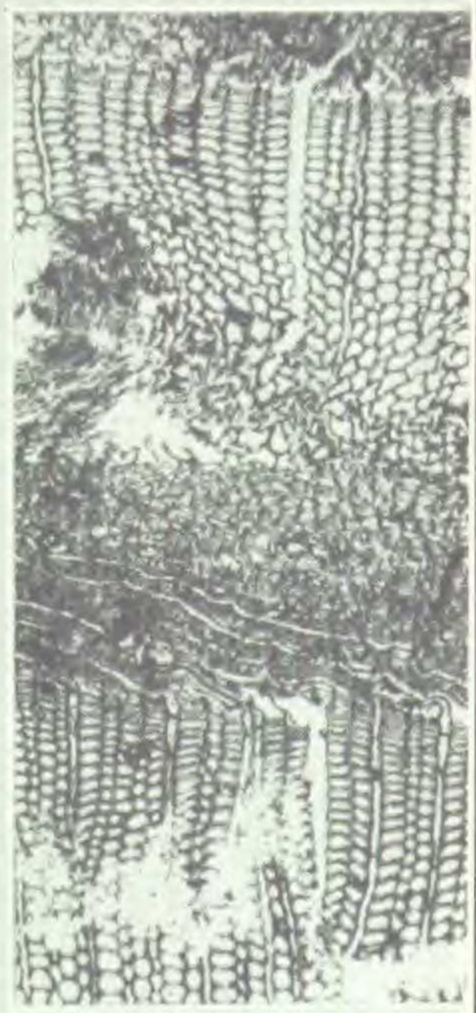

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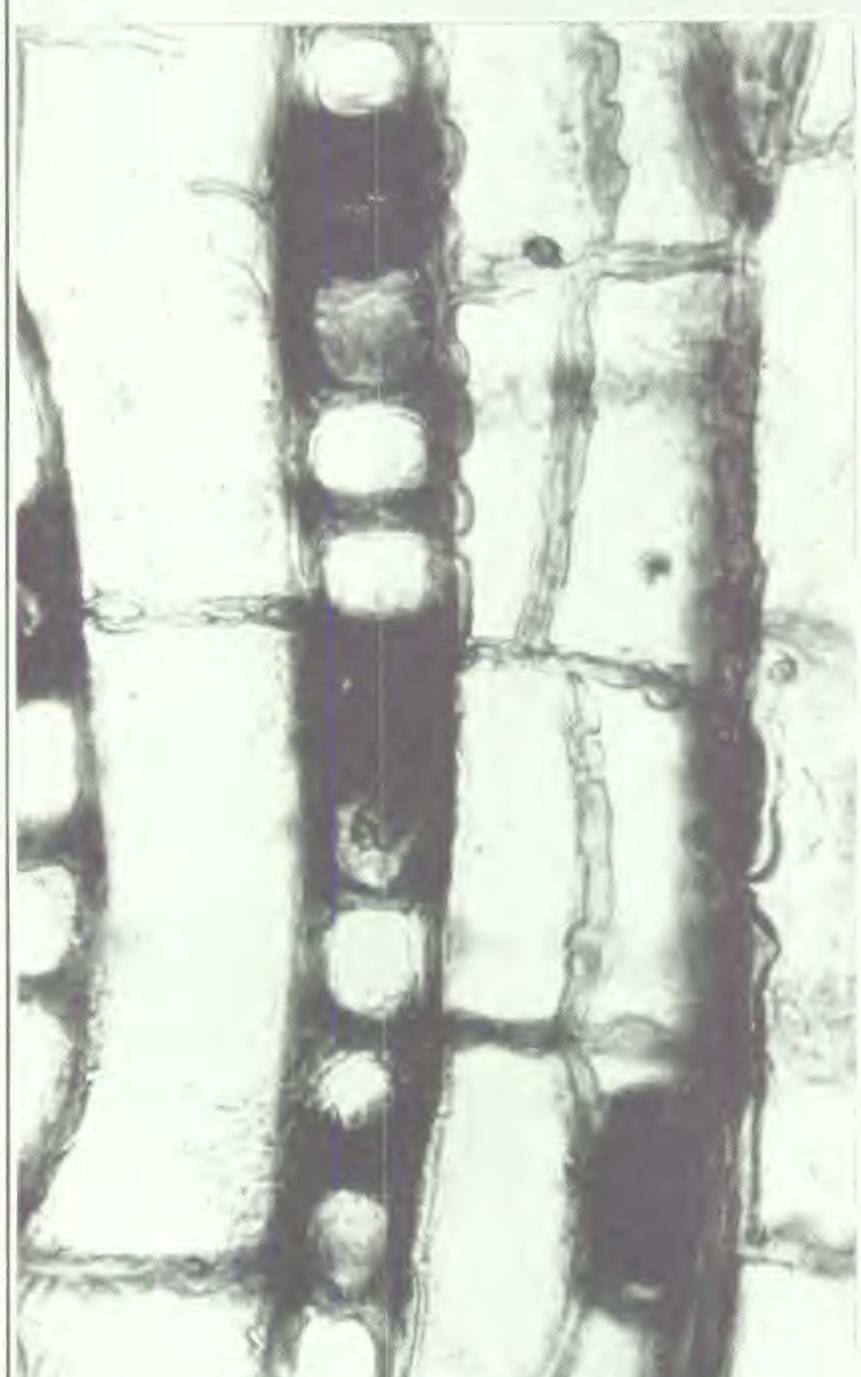

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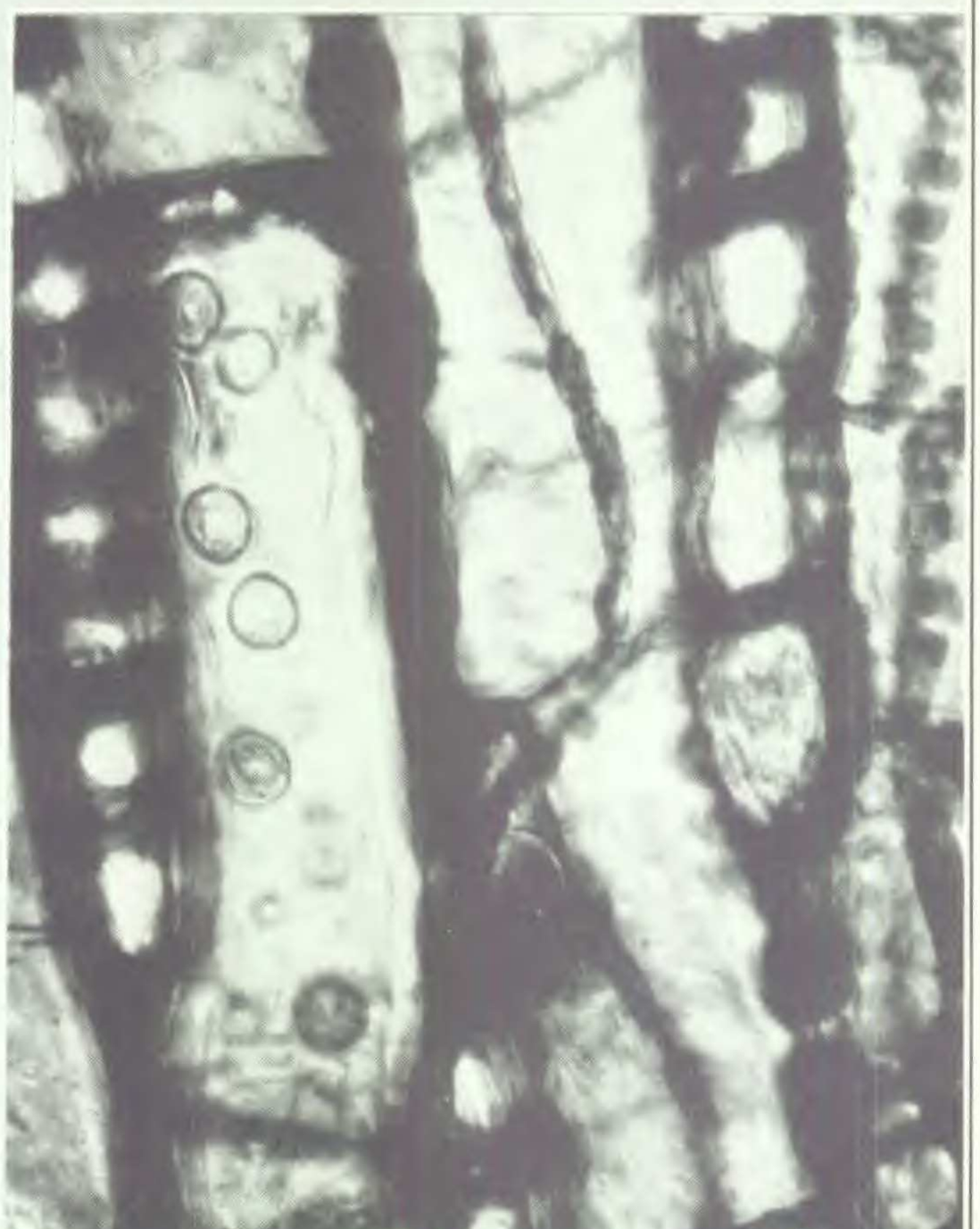

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ANDREWS—SEQUOIOXYLON PEARSALLII

EXPLANATION OF PLATE

PLATE 21

Sequoioxylon Pearsallii, n. sp.

Fig. 6. Transverse section showing gradual transition.
Fig. 7. Transverse section showing abrupt transition.
Fig. 8. Strand tracheids in late summer wood.
Fig. 9. Portion of same more highly magnified.